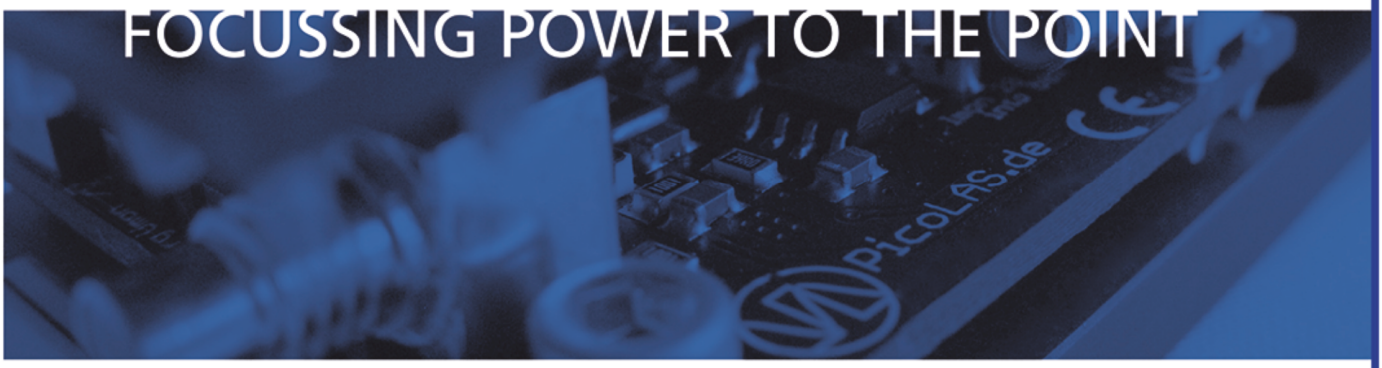
PicoLAS

FOCUSSING POWER TO THE POINT



User Manual

Rev. 14.04

PL-TEC 1-0305

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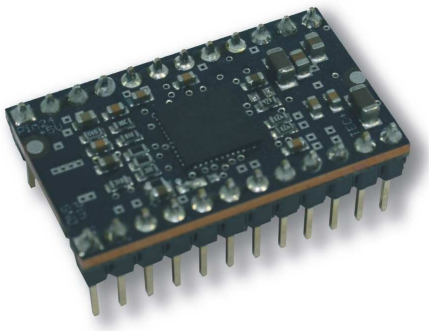
Rev. 09.02 valid from June 2009

PL-TEC 1-0305

Driver for TEC-Modules



- Bipolar ±3A output
- Temperature stability up to 0.001°C
- Adjustable TEC current and voltage limiting to protect TEC-module
- Direct TEC temperature control
- No additional heat sink required
- Low-ripple and low-noise design
- Multiple monitoring outputs

Product Description:

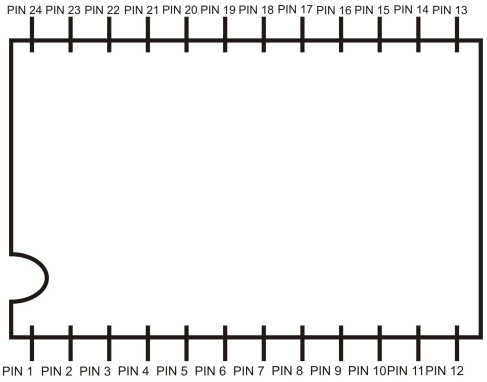
The PL-TEC 1-0305 is a very small, safe, and most accurate temperature controller for Peltier thermoelectric cooler (TEC) modules.
An ultra low-drift chopper amplifier maintains ±0.001°C temperature stability. Output current, rather than voltage, is directly controlled to eliminate current surges. Individual heating and cooling current limits and voltage limits provide the highest level of TEC protection.
The PL-TEC 1-0305 operates from a single supply and provides bipolar ±3A output by biasing the TEC between the outputs of two synchronous buck regulators. True bipolar operation controls temperature without “ dead zones” or other nonlinearities at low load currents. The control system does not hunt when the set point is very close to the natural operating point, where only a small amount of heating or cooling is needed.
An analog control signal precisely sets the TEC temperature. The actual TEC temperature and current can be monitored via analog outputs. In addition, separate over- and under-temperature outputs indicate when the TEC temperature is out of range. An on-chip voltage reference provides bias for a thermistor bridge.
Through the new efficient design, the PL-TEC 1-0305 itself requires no heat sink or other cooling method to reach its full output power.

Technical Data:*

Output current	Bipolar 2,5 A, 3A peak**
Output current limiting range	Heating: 0 .. 3 A Cooling 0 .. 3 A Independently limitable by external resistor
Max. output voltage (referred to the supply)	- 4.3 .. + 4.3 V (@+5V) - 2.3 .. + 2.3 V (@+3V)
Output voltage limiting range	0 .. 4.3 V by external resistor
TEC Temperature monitor	0 .. 1.5 V**
Supply voltage	+3 .. +5 V single supply
Temperature stability	0.001 K**
Monitor outputs	- TEC temperature monitor - Over- and under-temperature output (open collector) - TEC current monitor
Control inputs	- TEC temperature set point - enable (TTL level)
Power Dissipation	< 2.5 W
Dimensions in mm	30x18x7,5 mm DIP 24-6 package
Weight	8 g
Operating temperature	-20 to + 55 ° C

* Technical data is subject to change without further notice.
** See manual for detailed information.

Optional Accessories: PL-TEC-BOB


PIN 24 PIN 23 PIN 22 PIN 21 PIN 20 PIN 19 PIN 18 PIN 17 PIN 16 PIN 15 PIN 14 PIN 13
PIN 1 PIN 2 PIN 3 PIN 4 PIN 5 PIN 6 PIN 7 PIN 8 PIN 9 PIN 10PIN 11PIN 12

Pin Assignments and Description

Pin #	Short Desc.	Description
1, 2	GND	GND
3	FB+	Feedback Voltage input (thermal setpoint, analog Voltage 0... 1.5 V in). See page 6 for details
4	REF	1,500 V Reference Voltage output. Max load 50 µA (>36k to GND)
5	Itec	Tec Current-monitor output. The output voltage corresponds to the current by: I_{tec} = (Ua -1,5 V)/0,4. A readout of 1,5 V means zero current, 1,9 V = 1,0 A pos, 0,7 V = 2 A neg. Accuracy +/- 10%
6	MaxIP	Maximum Positive TEC Current. Connect MAXIP to REF to set default positive current limit +150mV / 0.05R = 3 A. This pin is tied to 1.5 V ref by an 47k Resistor. So use any resistor to GND to reduce maximum positive current. See page 7 for details.
7	MaxIN	Maximum Negative TEC Current. Connect MAXIN to REF to set default negative current limit -150mV / 0.05R = 3 A. This pin is tied to 1.5 V ref by an 47k Resistor. So use any resistor to GND to reduce maximum negative current. See page 7 for details.
8	Rth+	Connect the NTC between Rth+ and Rth-. NTC value must be around 10k.
9	Rth-	NTC return
10	GND	GND
11,12	Tec +	Power outlet for the TEC. Connect both pins together.
13,14	Tec -	Power return for the TEC. Connect both pins together.
15	GND	GND
16	n.c.	
17	MaxV	Maximum Bipolar TEC Voltage. Internal Resistor divider (47k to 1.5V and 150k to GND) provides the maximum voltage across the TEC. The maximum TEC voltage is four times the voltage on this pin. Connect any Resistor to GND to reduce MaxV-TEC-Voltage. See page 7 for details.
18	/Shdn	Enable Input. Tie to Vcc to enable unit, a connection to GND will disable the unit. No internal pullup resistor.
19	/OT	Over-Temperature Alarm. Open-drain output pulls low if temperature feedback rises 20mV (typically +1.5°C) above the set-point voltage. Typ. sinking current 4 mA
20	/UT	Under-Temperature Alarm. Open-drain output pulls low if temperature feedback falls 20mV (typically +1.5°C) below the set-point voltage. Typ. sinking current 4 mA
21	Tntc	NTC temperature monitor output: 0...3 V. See page 6 for details.
22,23,24	Vcc	Supply Voltage input (single Supply +3 to +5 V)

Minimal Operating Environment

For correct operation at least one additional 10ok poti for the temperature setpoint is necessary: Connect the +5V to Pins 22, 23, 24, and 18; GND to 1,2,10 and 15; the poti to the Pins 2, 3 and 4; the NTC to the Pins 8 and 9 and finally the TEC to the pins 11&12 vs. 13&14. The TEC and NTC are part of the common butterfly package of laser diodes.

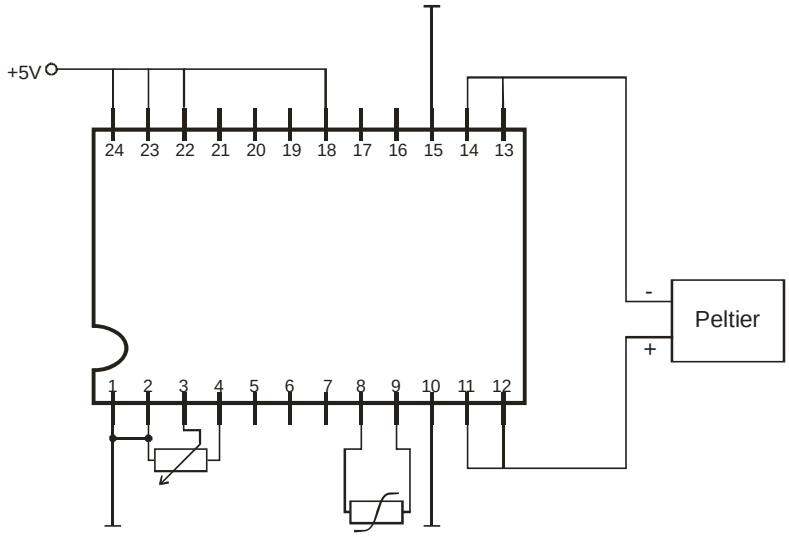


Fig. 1: Minimal operating environment

Typical Operating Environment

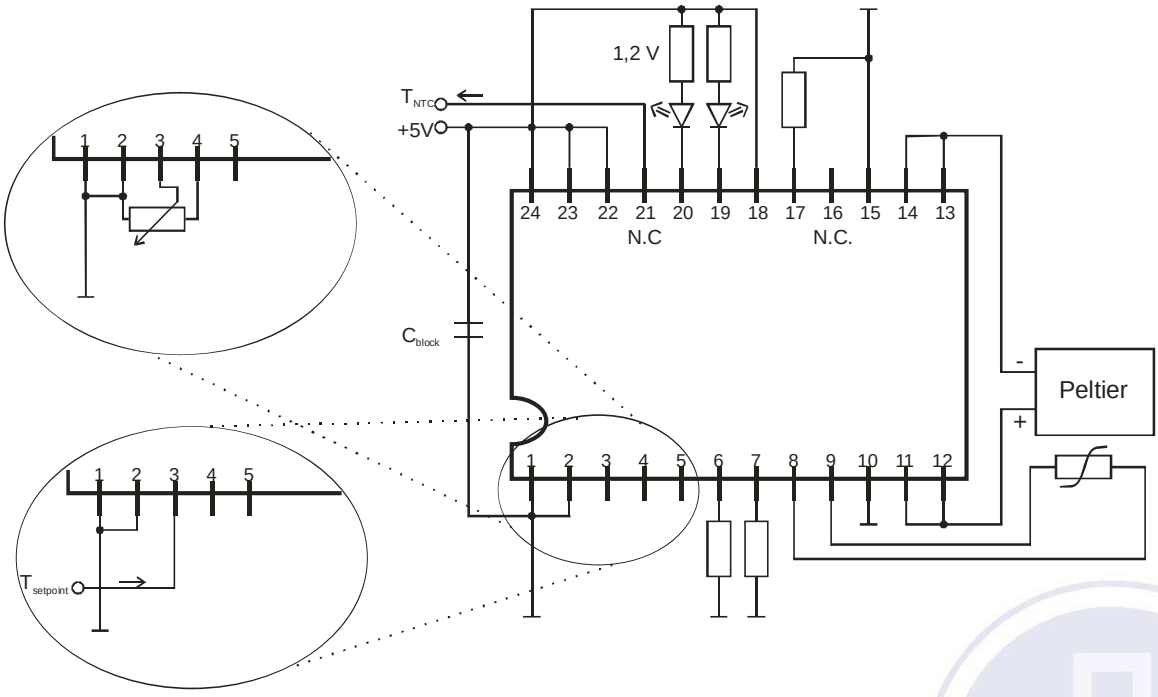


Fig. 2: Typical operating environment

Typically, the PL TEC 1-0305 Driver can be operated using the above environment.
The two resistors connected to Pins 6 and 7 adjust the maximum TEC-current and a resistor connected to Pin 17 adjusts the maximum TEC voltage corresponding to table 1 (page 7).
Pins 20 and 19 are open collector outputs which can be used to drive LEDs to signal a critical over- or under-temperature condition, respectively. These diodes have to be an ultra low current type. The series resistors limit the current which flows into the Pins to a maximum of 4 mA.
The voltage applied to pin 3 is adjusting the temperature setpoint. However, the signal from the NTC is not linear. See figure 4 for details. The current through the TEC can be monitored at pin 5.
Depending on the power supply an additional blocking capacitor (C_{Block}) may be necessary.

Wheatstone Bridge

For improved temperature stability the reference network and the feedback network are linked to the same reference voltage. However, this yields in a full Wheatstone bridge. Any influence on the reference voltage will have the same effect on the measured temperature and the setpoint.

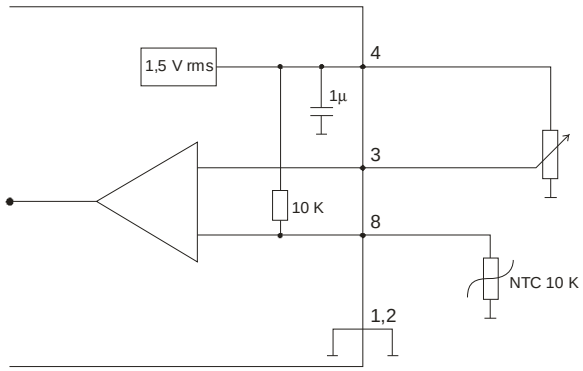


Fig. 3: Part of Fig 1.

Temperature Setpoint and Monitor

The temperature setpoint input voltage corresponds to the TEC-temperature through the voltage of the NTC. The voltage of the NTC again depends on its B-value and the temperature. Figure 4 shows the correlation between TEC-temperature and setpoint voltage for different B-values of 10kΩ-NTCs.

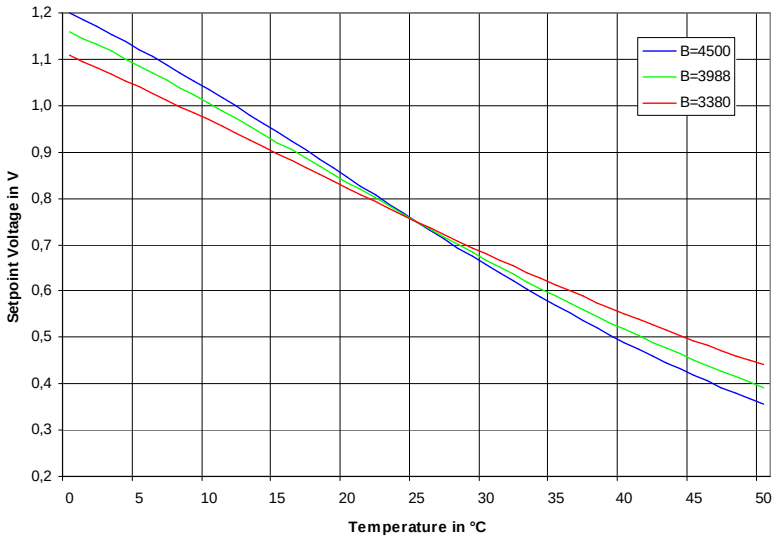


Fig. 4: Setpoint voltage for different B-values of 10kR NTC-Resistors.

The temperature monitor is equal to the voltage of the NTC, but for a better readability, the NTC voltage is inverted and amplified. The following graph shows the relation between the NTC temperature and the monitor output voltage.

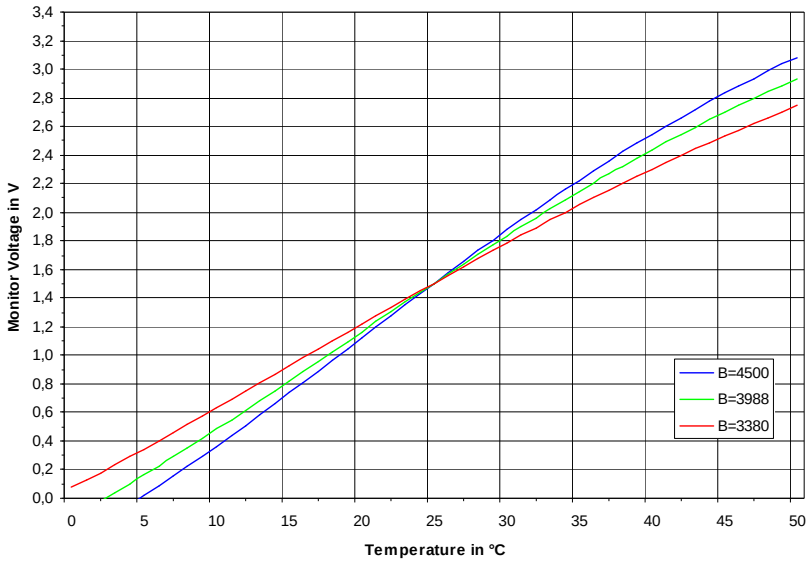


Fig. 5: Monitor voltage for different B-values of 10kR NTC-Resistors.

Setting TEC Voltage and Current Limits

TEC voltage and current limits are adjusted by connecting a resistor between ground and the corresponding pin of the PL-TEC-1-0305. The following table shows the relation between the resistor value and the voltage/current limit:

R_{ext} in kΩ	$V_{tec,max}$ in V
10	1,05
12	1,22
15	1,45
18	1,66
22	1,91
27	2,19
33	2,48
39	2,72
47	3,00
56	3,26
68	3,55
82	3,81
100	4,08
Open	4,3

R_{ext} in kΩ	$I_{tec,max}$ in A
10	0,53
15	0,73
22	0,96
33	1,24
47	1,50
68	1,77
100	2,04
150	2,28
220	2,47
330	2,63
470	2,73
680	2,81
1000	2,87
Open	3,00

Table 1: Resistor values for TEC current and voltage limits

Tec-Current Monitor

The current which is driven through the TEC module can be monitored at PIN 5 (Itec). The output voltage corresponds to the current by: I_{tec} = (Ua -1,5 V)/0,4. A readout of 1,5 V means zero current, 1,9 V = 1,0 A pos, 0,7 V = 2 A neg. Accuracy +/-10%. The diagram shows the full trace including the internal offset.

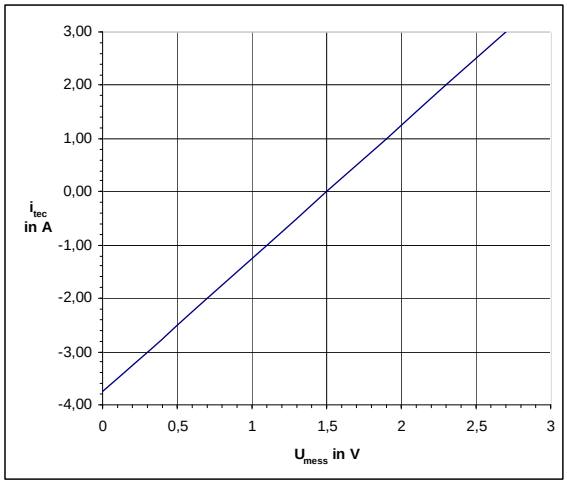


Fig. 6: TEC current monitor output voltage vs. TEC current

Absolute Maximum Ratings (destroying limits)

- All Input Pins must not exceed the voltage range below zero (GND) and beyond VCC
- VCC Limit: +6V
- Peak TEC-Current: +/- 4.5 A
- Max /UT /OT current: 10mA
- Ref-Voltage: Current Sink (into Pin) 100µA, Source 800µA

Warranty

There are no warranties, express or implied, including any implied warranty of fitness for a particular purpose nor any IMPLIED WARRANTY OF MERCHANTIBILITY made by PicoLAS GmbH except as follows:

PicoLAS warrants equipment manufactured by it to be free from defects in materials and/or workmanship under conditions of normal use for a period of one year from the date of shipment to the purchaser. PicoLAS will repair or replace, at PicoLAS´ option, any product manufactured by it which is shown to be defective or fails to perform within specifications within one year from the date of shipment to the purchaser. OEM, modified and custom items of equipment are similarly warranted, for a period of ninety (90) days from date of shipment to the purchaser.

Equipment claimed to be defective must be returned, transportation prepaid, to PicoLAS in Aachen, Germany, within the warranty period. Returns must be preauthorized by contact with PicoLAS´ customer service department. Returns without an RMA-Number and/or incorrect RMA documentation and/or without prepaid transportation will be refused. Written documentation of such preauthorization shall be included with the returned item.

At PicoLAS´ discretion, PicoLAS may elect to repair or replace the equipment claimed to be defective or refund the original purchase price, plus taxes and transportation charges incurred by the purchaser.